

## **Getting on the Air: A Novice Primer for New and Returning Hams**

### **I: Introduction**

### **II Handy Talkies**

### **III Repeater Operations: Best Practices**

**Congratulations** for winning your ham radio license. May your efforts be rewarded many times over. Ham radio offers tens of thousands of frequencies (channels) with power limitations up to 1.5 kilowatts; but the most important frequencies are located in the 2m and 70cm amateur bands. Better still, it offers an extended family of kindred radio enthusiasts who recognize its many values, one is serving our community and society.

This short tutorial will assume that you have a technician's license and already have a dual-band (2m and 70cm) handheld radio, battery charger, and rubber antenna; but not much else.

Unlike the internet, cell phones, pagers, or telephones, ham radio communications simply depend on one's own radio, antenna, and emergency/backup power system which any competent radio operator knows how to maintain and utilize. Such is all incorporated as one in the modern hand-held radio (the Handy Talkie or commonly called, the HT).

### **Handy Talkies (the HT or commonly called the hand held)**

The HT has a removable rubber like flexible antenna (fondly called the rubber ducky), a built in transceiver (transmitter and receiver), and a removable and chargeable battery pack. This allows for portable and mobile usage in one compact single unit.

The modern HT has a built-in small computer and memory allowing for customized settings, control, and storage of memory channels that can be instantly recalled. Let's breakdown the cogent elements.

**The Antenna:** The rubber ducky is a compromise antenna system that allows for easy portable usage, but suffers from lack of efficiency. In short, it is the worst antenna in terms of reception and transmission distances. It is OK for short range usage and/or working repeaters. Repeaters being high power stations at hilltop locations suited with excellent antennas who can receive weak signals and retransmit them instantaneously (called full duplex) with amplification. Hence a decent repeater can connect two stations using HTs who are more than 50 miles apart but re both in range of a repeater. We will elaborate upon repeater operation later; but just to say that the rubber ducky antenna needs to be improved.

Antennas are rated in terms of dB gain. The standard is the isotropic antenna which is assigned an artificial standard of 0 dBi or unity gain. Antenna gain is also measured in terms of decibels over a dipole (the most common general radio antenna). The dipole has a 2.2 dBi

gain over an isotropic antenna, which is almost doubles the Effective Radiated Power (ERP). For every 3 dB gain your signal doubles in effective power and your ability to receive also doubles every 3 dB. Pay attention to dBi versus dBD as these two measures differ significantly. Unscrupulous manufacturers often take advantage of this inattention making outlandish claims for their antennas without indicating what the gain is measured against. The phrase in ham radio for that, is gain over a “wet noodle”.

A rubber ducky antenna is minus 3 or 4 dB gain, hence it is not very good for reliable distant communications.

Solution one: Obtain an extended rubber whip (15”) or larger. They are bit awkward to carry in purse or pocket and can too easily poke places or people unwantedly; but they are a vast improvement over the standard rubber ducky. A popular and reliable model is the Nagoya NA-771 a 15.6-Inch Dual-band Whip, assuming that you have a dual-band HT; but beware of Chinese knock-offs, which abound.

Another solution is to make your own  $\frac{1}{4}$  wave 19.2 inch long home made 2 meter vertical that will attach to your HT. The cost is approximately \$2 and you wind up with a 2.2 dBi gain.

Better still is an outside external antenna connected to your radio with suitable connectors and high quality transmission line (low loss coaxial cable). Unfortunately the longer the antenna and the higher up that it is mounted, the better; albeit there is a limit of diminishing returns once the antenna becomes larger than 8 feet long and once it gets in the clear from surrounding obstructions. KaroEcho recommends the Diamond X200-a (\$125) or the less expensive Tram 1400 (\$50). For a 5’ antenna with 2.2 DBd gain (4.4 dBi) , the Ed Fong Dual band J-pole or any other dual band J-pole will bring decent results. Also Comet makes a Ringo Ranger Antenna at 9 feet. All these are excellent.

Sometime we are assigned to mobile or portable operations. For mobile operation a mag-mount antenna (magnet mounted) antenna is most convenient. Get one that is at least 36” long minimum in order achieve decent gain. They come in many flavors and removable bases (NMO or UHF bases are the most common). Make sure that they are dual-band. These mag-mounts can be used inside the building for indoor portable assignments when used with a metal base such as a oven pan, sheet metal rectangle, metal pizza pan, and similar. Such a mag-mount antenna would be much more reliable than using a rubber ducky.

Another indoor solution is an indoor dual-band j-pole made from ladder line or twin-lead that you can hang from the ceiling, wall, or fixture, which will dramatically increase the range of your signal (approximately 2.2 dBD or 4.4 dBi gain). One can build their own or obtain the N9TAX Dual-band Slim Jim preassembled with connectors on the internet.

Antenna building and theory are very large topics in ham radio. Volumes of books are

written and terabytes of discussions exist on the internet; however the above is gleaned from many years of experience and should get anyone started.

### ***Memory, Programming, and Operations:***

Each HT has its own characteristic operating panel and menu; but brands such as Baofeng for example, have nearly identical menus and commands; hence operators with similar radios can help each other go through any rough spots.

The most common stumbling block for newbies is entering frequencies into memory channels (programming in order to achieve instant recall at a later date). Without exception all HTs are difficult to program.

Understanding the two major modes of operation; i.e., **Repeater Operation (duplex) versus Simplex (direct line of sight) operation** will make this subject more than approachable.

For **simplex modes** (at least with Baofengs) choose VFO (sometimes called frequency) mode, and simply type in the numeric frequency that you desire. This works perfect for simplex operation. Simplex means that the two stations are talking directly (without a repeater) on the same frequency.

**Duplex modes** are used with repeaters; however, they are a bit more complex to enter into your memory. Every brand of HT will differ in the procedure. Duplex (repeater operation) requires a Private Line (PL) tone at a specific frequency and a transmit offset frequency. The standard offset is plus 5 MHz for 70cm. For 2m repeaters the offset is 600Hz (.6 MHz) but it can either plus or minus. Repeater directories are somewhat helpful; but please ask a local ham who knows your location and radio to help. Most hams use the freeware computer program Chirp and a suitable cable) to program their radios via computer. Ask a **Karo-Echo** mentor to help.

Scanning and fine tuning comes later. For now the primary directive is to use the PTT (Push to Talk) button to transmit. Let go of it and pause often to receive. For further info send email to HYPERLINK "mailto:info@karoecho.net" [info@karoecho.net](mailto:info@karoecho.net)

### ***The Backup Power System***

One battery is not enough, because when it fails you are off the air for 1-12 hours depending on the type of charging system you have. Li-Ion batteries are better than Ni-MH (Metal Halides) and Nicads. At the minimum have at least one spare battery pack and a quick charger. Three is better. Have a plan what will you do when the power fails.

Are your batteries charged fully? Do you have a spare alkaline auxiliary pack and extra alkaline batteries? Can you use your automobile battery to operate your radio through a cigarette lighter adaptor? Do you have a 12 volt deep cycle battery and suitable adaptors

from 12 V dc to your radio for power and charging your radio's battery?

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## **Best Operating Practices for Repeater Operation:**

See the above discussion regarding setting your PL (CTSS) tones and offset. See the discussion on duplex operation to understand how repeaters work. When you key up a repeater you will hear a squelch tail that will break your squelch. Most repeaters send a courtesy (audible) tone when the last station to trip it finishes. That is a signal for you to transmit if you desire. Always wait for the squelch tail to fade out before transmitting because all repeaters have a timer that is reset after the repeater unkeys. That is, the repeater has a short delay after it is tripped.

Timers are normally set from 60 seconds (short) to 2 minutes (long) at the discretion of the repeater owner. Most Bay Area repeaters are open to all. It is always courteous to leave a long paused space between the end of the squelch tail before you key down (push your PTT button). This allows for other waiting users to also use the repeater.

If a user transmits beyond the repeater's time-out settings, the repeater will drop out and then reset. It's called a timeout. In the vernacular, we say that the alligator gotcha. Timers on repeaters will vary. Keep transmissions short. Pause and drop the PTT often. Be courteous and friendly.

Repeaters typically transmit with 50 watts into excellent gain antennas. A HT typically transmits 5-8 watts into an inferior antenna, often resulting that you hear the repeater, but the repeater does not hear you.

You might hear a repeater well, but are unable for it to hear you. After confirming that your PL (CTSS) tone and offset are correct, you might need more power or a better antenna. If the repeater is weak at your location, an amplifier will not help you. You will be better served by obtaining a better antenna.

In Kensington and El Cerrito there are over a hundred repeaters that can be reached with only 5 watts if you have a decent antenna. Ask [HYPERLINK "mailto:info@karoecho.net" info@karoecho.net](mailto:info@karoecho.net) for a repeater list or programming help.

## **Annotated Glossary -- Know the meaning of these terms:**

**Squelch:** Set your squelch control to its lowest setting before the white noise trips your

speaker. This will give you the best copy on weak signals.

**PTT Button:** This is your Push to Talk Button or transmit button. Use it sparingly and let it go when thinking, pausing, or on purpose to allow others to break in.

**Scratchy:** Scratchy is a weak signal report that states there is much noise on your signal (it sounds like sandpaper) on your signal. It means that your signal is readable but borderline/weak.

**Simplex:** Direct radio to radio communication without a repeater usually in the same channel without the aid of a repeater. This was normal radio communications before the advent of repeaters and trunk lines. Radio manuals often refer to this mode as vfo mode or frequency mode.

**Duplex:** Operation through a repeater occurs where the repeater's input frequency is different from its transmit frequency, thus creating an offset. This allows the repeater station to receive a weak signal, amplify it, and retransmit it to distant stations in range of the repeater.

**Offset:** In duplex (repeater) operation the offset is the separation of the transmit frequency from your receive frequency. On 2m it is usually 600 Hz. On 70cm it is usually 5 MHz.

**PL Tone Code:** Also known as **CTCSS** (Continuous Tone Coded Squelch System). PL is an acronym for Private Line, which is a sub-audible tone sent from your transmitter to activate or trip the selected repeater. This prevents undesired activation of the repeater. "The tone is transmitted at a low level simultaneously with the voice. This is called CTCSS encoding. CTCSS tones range from 67 to 257 Hz. The tones are usually referred to as sub-audible tones. In an FM two-way radio system, CTCSS encoder levels are usually set for 15% of system deviation. . . n a communications receiver designed for CTCSS, a high-pass audio filter is supposed to block CTCSS tones (below 300 Hz) so they are not heard in the speaker. Since audio curves vary from one receiver to another, some radios may pass an audible level of the CTCSS tone to the speaker. Lower tone frequencies generally are less audible. . . A receiver with just a carrier or noise squelch unmutes for any sufficiently strong signal; in CTCSS mode it unmutes only when the signal also carries the correct sub-audible audio tone. The tones are not actually below the range of human hearing, but are poorly reproduced by most communications-grade speakers and in any event are usually filtered out before being sent to the speaker or headphone." ~ Wikipedia  
Always set the proper PL tone for repeater operation; but avoid doing so for receiver squelch operation.

**Hz:** The abbreviation that measures radio wave frequency in cycles per second. Hz nomenclature is named for Heinrich Rudolf Hertz, the first person to provide conclusive proof of the existence of electromagnetic waves. Examples, AC power lines, voice, music,

sound.

**KHz:** Frequency measurement in terms of a thousand cycles per second. Example, the AM band.

**MHz:** A million cycles per second. Examples, shortwave, FM Band, TV band, VHF, UHF.

**GHz :**A thousand million cycles per second. Examples, microwaves, WiFi, Cell phones

**Wavelength:** The length of a radio wave measured in meters. Meters can be interpolated as frequency, and vice versa.

**Mobile Station:** A radio station suitable for installation in an automobile running off of 12 VDC. Also suitable for portable operation, but not as versatile as a HT.

**Base Station:** A higher powered and often bulky transceiver not suitable for portable or mobile operation.

**Rubber Ducky:** A lossy small rubberized short antenna that is often used with HTs for repeater operation. They have negative dBi gain

**Decibel:** Abbreviated as dB, it is a measure of comparative signal strength.

**Gain:** measured in dBs. For every 3 dB gain your signal strength is considered to be doubled. Useful in evaluating antennas. The expression dBi is used to define the gain of an antenna system relative to an isotropic radiator at radio frequencies. The symbol dBi is an abbreviation for "decibels relative to isotropic. A dipole antenna has a gain of 2.2 dBi. An isotropic radiator has a gain of 0 dBi. Rubber duckies have a negative gain (-dBi). A stacked collinear antenna 8 feet tall can have 6 to 8 dBd gain over a dipole on 2m and 70cm. A beam antenna such as a yagi or quad can provide as much as 20 dBd gain or more and is used for moon bounce, satellite work, and DX (distance work).

**Isotropic:** An isotropic antenna is an mythical antenna that radiates its power uniformly in all directions. There is no actual physical isotropic antenna. However, an isotropic antenna is often used as a reference antenna to measure antenna gain in dBi. The antenna gain is often specified in dBi, or decibels over isotropic. A dipole antenna at any resonant frequency is measured at 2.2 dBi. Hence a vertical dipole (or vertical) is given the value of 2.2 dBi if it is 100 efficient. Radio antenna "science" is a large topic

**2m Ham band:** 144-148 MHz. 2 meters is the most populated VHF ham band used for disaster communications.

**70cm Ham band.** 420-450 MHz in the UHF spectrum is the second most used ham repeater band.

**RACES:** Radio Amateur Civil Emergency Service. A formal amateur radio service agreement with a government agency controlled by government officials.

**ARES:** Amateur Radio Emergency Service, a service of the America Radio Relay League (ARRL)

**OES:** Office of Emergency Services

**AEC:** Assistant Emergency Coordinator. See EC for more.

**EC:** Emergency Coordinator who is appointed by the executive board. The EC appoints assistants (AECs)

**EOC:** Abbreviation Emergency Operations Center located across from main El Cerrito FD in the Public Safety Building. Each city and county have their own EOCs.

**ERP:** Effective Radiated Power. Usually calculated by RF output in watts times the gain of the antenna over a theoretical dipole (dBd). EIRP is the effective radiated power using a theoretical isopole (dBi), which is theoretically 2.5 db less efficient than dBd. Examples: 5 watts RF output using a dipole antenna would equal 5 Watts ERP. Using 5 watts RF output a 3 dBd gain antenna, the ERP would be 10 watts.

**FRS:** Family Radio Service limited to .5 watts on channels 8-15, and 2 watts on ch.1 – 7 and 2 watts on Ch. 16-22. External antennas are not allowed. FRS works well for short distance radio communications within buildings and blocks (line of sight) depending upon terrain.

HYPERLINK "[https://www.google.com/url?](https://www.google.com/url?q=https%3A%2F%2Fwww.fcc.gov%2Fgeneral%2Ffamily-radio-service-frs&sa=D&sntz=1&usg=AFQjCNENITLy38BXJt1oi_IrID_hXMhRMA)

[q=https%3A%2F%2Fwww.fcc.gov%2Fgeneral%2Ffamily-radio-service-frs&sa=D&sntz=1&usg=AFQjCNENITLy38BXJt1oi\\_IrID\\_hXMhRMA" \t "\\_blank" https://www.fcc.gov/general/family-radio-service-frs](https://www.fcc.gov/general/family-radio-service-frs)

**GMRS:** General Mobile Radio Service uses channels from around 462 MHz to 467 MHz. The most common use of GMRS channels are for short to medium distance two-way communications using hand-held radios similar to walkie-talkies, base stations, and repeaters. A small base station is one that has an option of an outside antenna and can transmit with no more than 5 watts on channels 1-7, .5 Watts on channels 8-15, and 50 watts on the rest of the GMRS frequencies ( Ch. 16-22) HYPERLINK "[https://www.google.com/url?q=https%3A%2F%2Fwww.fcc.gov%2Fgeneral%2Fgeneral-mobile-radio-service-gmrs&sa=D&sntz=1&usg=AFQjCNGs82gYAIxb\\_A-SUaLAI-fLcwjFvA" \t "\\_blank" https://www.fcc.gov/general/general-mobile-radio-service-gmrs](https://www.google.com/url?q=https%3A%2F%2Fwww.fcc.gov%2Fgeneral%2Fgeneral-mobile-radio-service-gmrs&sa=D&sntz=1&usg=AFQjCNGs82gYAIxb_A-SUaLAI-fLcwjFvA)

**OLD FRS/GMRS Channel nomenclature:** Please note that the channel designators for GMRS and FRS changed as of September 1, 2017 For example: channel 7 FRS is the old

GMRS channel 15 but the frequency is the same 462.7125 MHz. This information may be useful to avoid confusion for those who have older equipment. In the new radios Channels will be designated 1-22 in both FRS and GMRS services.

**GMRS and FRS Dual Service Radios:**

Many manufacturers have in the past received FCC type approval to market radios that are certified for use in both GMRS and FRS (called dual service radios). Others market FRS only or GMRS only radios.

Radios marketed as "FRS/GMRS" or "dual-service radios" are available from many manufacturers and many retail or discount stores. The manual that comes with the radio, or the label placed on it by the manufacturer, should indicate the service the radio is certified for. If you cannot determine what service the radio may be used in, contact the manufacturer. If you operate a radio under the GMRS rules, you must have a GMRS license. GMRS radios generally transmit at higher power levels. In GMRS 5 watts is typical on channels 1-7, .5 watts on ch. 8-15, and 50 watts on the other GMRS channels). GMRS only radios may have detachable antennas as compared to FRS radios with non-detachable antennas. Hence, GMRS will increase the range of your communications considerably.

Since, November 2017, dual service radios have been discontinued in the US due to new FCC rules mandating radios to be either FRS only or GMRS only. FRS operation does not require an FCC license, if you operate a radio that has been approved for FRS and restrict operations exclusively to the FRS channels with a maximum power of 2 watts effective radiated power (ERP) and with an integral (non-detachable) antenna. In both FRS and GMRS Channels 8-14 are restricted to .5 watt (1/2 watt)

GMRS radios can operate at 5 watts on channels 1-7, 50 watts on channels 15-22, utilize external antennas, and repeater operations.

**Ham:** A FCC licensed amateur radio operator capable of high power, thousands of channels, and long distance communications.

**IC:** Incident Commander. Person in charge of the overall operation

**ICP:** Incident Command Post (Please designate what CERT Area ICP that one is contacting; e.g., areas may have individual ICPs as well as blocks. Please use tactical designators.

**ICS:** Incident Command System. Used for interoperability to integrate diverse disaster services agencies under a single command (Incident Commander – IC).

**KHz:** Kilohertz. An frequency abbreviation for one thousand Hertz (cycles per second).

**Logistics Net:** A net dealing with the procurement, maintenance, and transportation of



material, facilities, staffing, and scheduling personnel during a disaster.

**Resource Net:** For larger-scale incidents, a Resource Net is used to recruit operators and equipment in support of operations on the Tactical Nets. As an incident requires more operators or equipment, the Resource Net evolves as a check-in place for volunteers to register and receive assignments. Also used to track personnel back and forth safely to and from assignments.

Resource Nets may be combined within and under Logistics (a Logistic Net) unless traffic becomes too heavy. In case of heavy traffic, a new frequency and net control station should be established for an independent Resource Net apart from the Logistics Net.

**Tactical Net:** The Tactical Net is the front line net employed during an incident, usually used by a single government agency to coordinate with Amateur Radio operations within their jurisdiction. There may be several tactical nets in operation for a single incident depending on the volume of traffic and number of agencies involved. Communications include traffic handling and resource recruiting.

**Command Net:** As the size of an incident increases and more jurisdictions become involved in the incident, a Command Net may become necessary. This net allows the incident managers to communicate with each other to resolve inter- or intra-agency problems, particularly between cities or within larger jurisdictional areas. It is conceivable that this net could become cluttered with a high volume of traffic. It may also be necessary to create multiple command nets to promote efficiency.

**Directed Net:** The Net Control Station (NCS) is in charge of the operation. For routine or priority traffic say break. For emergency traffic say: “break break”. The NCS will say: “station go ahead”. Then identify yourself and list your traffic. The NCS will then give further procedural instructions. For emergency traffic it is best to say, “EMERGENCY” and then the NCS will recognize you. Use “break” for routine traffic and say, “PRIORITY” for priority traffic.

**NCS:** Net Control Station

**Triage areas:** Locations used to evaluate medial casualties and/or to perform temporary emergency medical treatment if required.

**SAR:** Search and Rescue

**CERT:** Community Emergency Response Team. There are 11 designated areas in El Cerrito and 6 in Kensington, for a total of 17 CERT Areas. See EC CERT map: [HYPERLINK "http://www.google.com/url?q=http%3A%2F%2Fel-cerrito.org%2FDocumentCenter%2FView%2F3358&sa=D&sntz=1&usg=AFQjCNE-wHlvk\\_kd7-nQzJBN-gLLTrjWIw" \t "\\_blank"](http://www.google.com/url?q=http%3A%2F%2Fel-cerrito.org%2FDocumentCenter%2FView%2F3358&sa=D&sntz=1&usg=AFQjCNE-wHlvk_kd7-nQzJBN-gLLTrjWIw) <http://el-cerrito.org/DocumentCenter/View/>

Transmission Lines (coax): Normally hams use 50 ohm coax to connect their transceivers to external antennas. All coax is lossy depending on length and frequency, The longer the length and higher the frequency the loss increases. Low loss coax is available starting with the LMR-400 series, 9913 series, and Rg-213. The first two are best. For short runs (less than 50') LMR 200 or rg8X (mini foam) may be a good compromise of value versus performance. Loss at 2m is considerably less than loss at 70 cm.

### **References:**

Helpful manuals and reviews for inexpensive HTs, amplifiers, and mobile stations.

HYPERLINK "http://miklor.com/" <http://miklor.com/>

Diamond x-200A outdoor rooftop antenna. HYPERLINK "https://www.diamondantenna.net/x200a.html" <https://www.diamondantenna.net/x200a.html>

Tram 1480 equivalent antenna: HYPERLINK "https://www.eham.net/reviews/detail/2276" <https://www.eham.net/reviews/detail/2276> Available at Home Depot, Amazon, Walmart, Ebay, etc.

The portable indoor/outdoor Slim Jim dual band vhf/uhf antenna HYPERLINK "http://www.n9tax.com/slim%20jim%20info.html" <http://www.n9tax.com/slim%20jim%20info.html>

Or make your own HYPERLINK "http://www.abarc.club/documents/Ed\_Fong\_Antenna\_talk/dbj-2-%20slides\_hawaii.pdf" [http://www.abarc.club/documents/Ed\\_Fong\\_Antenna\\_talk/dbj-2-%20slides\\_hawaii.pdf](http://www.abarc.club/documents/Ed_Fong_Antenna_talk/dbj-2-%20slides_hawaii.pdf)

Nagoya 744 felx antenna. Make sure you get the correct antenna end connector (female or male SMA connector will differ by radio. Baofeng normally requires a female end connector to connect with its male on board sma connector. Many other manufacturers require a male sma end connector on the antenna side to connect with their female sma antenna on the radio's side. HYPERLINK "https://www.eham.net/reviews/detail/7741" <https://www.eham.net/reviews/detail/7741>

In order to avoid cheaply made knock-offs, you can be safe with the more expensive Diamond extended whip. With a male SMA end connector HYPERLINK "https://www.diamondantenna.net/srh77ca.html" <https://www.diamondantenna.net/srh77ca.html>  
For a Female SMA end connector HYPERLINK "https://www.diamondantenna.net/srj77ca.html" <https://www.diamondantenna.net/srj77ca.html>

BTECH at [baofengtech.com](http://baofengtech.com), located in the US, contracts with the Baofeng factory in China for high quality Baofeng radios that carry a warranty which they honor. Don't confuse BTECH with the average EBAY or Amazon Baofeng dealer. Their manuals and radios are scrupulous. These radios are approximately \$60 each. Compare to other HTs at 5 times the price.

Tri-band UV-5X3 HYPERLINK "<https://baofengtech.com/uv-5x3>" <https://baofengtech.com/uv-5x3>

BF-F8HP HYPERLINK "<https://baofengtech.com/bf-f8hp>" <https://baofengtech.com/bf-f8hp>

UV-82HP HYPERLINK "<https://baofengtech.com/uv-82hp>" <https://baofengtech.com/uv-82hp>

GMRS –V1 HYPERLINK "<https://baofengtech.com/gmrs-v1>" <https://baofengtech.com/gmrs-v1> (GMRS only)

The name brands (Icom, Kenwood, and Yaesu) are considerably more expensive and are available at Ham Radio Outlet in Oakland. HYPERLINK "<https://www.hamradio.com/>"

An excellent short primer written by Rob, K6RJM, on how to get started is on our web page at HYPERLINK "<https://www.karoocho.net/get-involved/getting-started>" <https://www.karoocho.net/get-involved/getting-started>

Chirp provides an open source free programming software that is most common in amateur radio. HYPERLINK "<https://chirp.danplanet.com/projects/chirp/wiki/Home>" <https://chirp.danplanet.com/projects/chirp/wiki/Home>

The national ham radio organization ARRL HYPERLINK "<http://www.arrl.org/>" <http://www.arrl.org/>

The East Bay Amateur Radio Club (EBARC) HYPERLINK "<http://ebarc.org/>" <http://ebarc.org/>

The Contra Costa Communications Club (operates the 145.110MHZ (-) PL 82.5 224.300MHZ (-) PL 82.5, 444.275MHZ (+) PL 82.5 repeaters and meets at Dennys on Potrero and San Pablo, El Cerrito. See HYPERLINK "<http://www.wa6kqb.org/>" <http://www.wa6kqb.org/>

Further, please see HYPERLINK "<https://www.karoocho.net/home>" <https://www.karoocho.net/home>

Courtesy of the Kensington Amateur Radio Operators – El Cerrito Ham Operators (KARO-ECHO)